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I N D E X

	Page
FOREWORD & REVIEW	1
CANADA	4
MEXICO	17
PRICES AND TRENDS	23
UNITED STATES SULPHUR	25
SULPHUR IN ITALY	27
O.E.E.C. CHEMICAL PRODUCTS COMMITTEE REPORT ON THE SULPHUROUS RAW MATERIAL POSITION IN 1952	28
UNITED KINGDOM SULPHUR	30
CURRENT EVENTS	
Australia	33
New Zealand	33
United States Sulphur Export Quota ...	33
Freeport Sulphur Company	34
Texas Gulf Sulphur Company	34
France	35
East German Anhydrite Sulphuric Acid Plant	35
Ecuador	36
Venezuela	36
Chile - Aucanquilcha	37
Japan - New Production	37
Japan - Statistics	37
STATISTICAL APPENDIX	38

F O R E W O R D

It is intended to publish a series of surveys on the sulphur situation in Commonwealth countries and this issue of the Bulletin contains the first of such articles.

An innovation which, it is believed, many readers may find useful, is the presentation of the principal features, commentaries and deductions contained in the Bulletin as a Digest in the Review below.

September, 1953.

R E V I E W

The first of the series of surveys of the sulphur situation in Commonwealth countries features CANADA. This Dominion, immensely rich in natural resources, also has unlimited amounts of sulphur which is contained in metal sulphides and in natural gas and oil. One of Canada's leading industries, the pulp and paper industry, however, has a marked preference for, if not essential need of, elemental sulphur. This is, at present, obtained without difficulty from the United States, but constitutes a dependence from which leading consumers would prefer to be relieved as far as possible. Recovered sulphur production from sour gas, though potentially it could replace by 1955 nearly one half of the anticipated brimstone imports, is handicapped, like the wider exploitation of pyrites deposits and by-product pyrites arisings, by distances between producing and consuming centres, which are reflected in high transport costs. Sulphur production in 1952 was about 400,000 tons per annum, of which about 45% was exported in the form of pyrites, primarily to the United States, but also to the United Kingdom and the Continent of Europe. Consumption was about 550,000 tons, the home deficit being balanced by

sulphur imports from the United States. Consumption is expected to rise about 20% by 1955 and indigenous production over 45%, so that a national balance of sulphur imports and exports is in sight. Complete self-sufficiency and the expectation that Canada may provide the United Kingdom with cheap elemental sulphur may have to await improvement of recovery techniques, particularly in respect of pyrites, but primarily the solution lies in a substantial reduction of the high transport costs.

A Survey of sulphur developments in MEXICO, in particular of the progress of work on the sulphur domes on the Isthmus of Tehuantepec, is the second feature. The expansion of sulphur production by the Frasch process from domes, by recovery from natural gases and by orthodox and modern methods from surface deposits, has Government support in view of the need of this raw material to feed an expanding fertiliser and chemical industry and also in the anticipation of disposing of a valuable export commodity. The geophysical structure of domes is feared to be less robust than that of their counterpart on the American shore of the Gulf and only actual production in each case will show whether the hopes of technicians and financial backers are to be realised. If all plans are successful, 1956 should see production of over 400,000 tons, of which 300,000 tons are expected to be exportable.

In the UNITED STATES, native sulphur production in the second Quarter rose 6½%, but sales, partly stimulated by the impending price rise on 1st June, increased 14%, with the result that, during the Quarter, stocks fell 123,407 tons. By comparison with the half-year of 1952, the slight rise in total and recovered sulphur production (0.9%) is dwarfed by the surge of apparent sales (9% up), which factor gains in significance as exports are 100,000 tons (15%) down.

In ITALY, the Ente Zolfi Italiani policy of fixed price purchasing has led to an increase of 9% in the half-year's production. Deliveries to the home market are slightly reduced, but exports are less than 1/10th compared with 1952, due to excessive prices. Slow progress, although officially thought satisfactory, is being made in re-equipment and modernisation of mines.

The report of the O.E.E.C. Chemical Products Committee regarding the sulphur position in 1952 in member countries

shows an improvement in the supply position, although insufficient emphasis is thought to be given to the effects of the trade recession in that year.

In the United Kingdom, sulphuric acid production in the second Quarter was 2% higher than during the preceding Quarter. The use of pyrites rose on new plants coming into operation, whereas the use of acid sulphur declined in absolute and relative terms. Sulphur recovered from oil refinery gases contributed increasingly to regular sulphur supply, as the ESSO plant at Fawley came on stream. Sulphur stocks continued their decline by a further 20,000 tons during the Quarter and, with third Quarter allocations of American supplies meeting only about one-half of actual consumption, the trend is accentuated.

World prices remained virtually unchanged during the last three months, with the exception of further easing of prices demanded by high-cost producers, notably Japan, who are trying to dispose of stocks below cost price. The supply position of cheap American Frasch sulphur is tighter and this has led several consumers to take up other supplies, notably Scandinavian, however, at prices competitive with or reasonably close to prices of United States material. In the absence of a trade recession in America, the present trend is expected to continue, creating a demand for small supplementary supplies.

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C A N A D A*

Canada's sulphur industry is undergoing significant developments. In line with the general industrial expansion, Canadian sulphur-using industries are calling for increasing quantities of this essential raw material. Although her requirements have received no less advantageous consideration than those of the United States industry, even at the height of the sulphur crisis, the principal consumers decided to lessen Canada's dependence on imports of American sulphur. This decision, it is thought, springs not entirely from an anxiety to ensure future supplies, although this is quite genuine, but from a desire to utilise the vast sulphur potential of the Dominion. This is based essentially on sulphur contained in metal sulphides, natural gas and oil. Native sulphur is virtually non-existent and the only rock deposit - located in Alberta and investigated by the Sunbeam Sulphur Company - so far shows no promise of production. The exploitation of anhydrite and gypsum deposits in Ontario and the Maritime Provinces was shelved after initial consideration by Atlantic Chemicals Ltd. as not being economically tenable at present.

The anticipated developments of the next three years underline the difficulties facing the industry in its aim to achieve greater self-sufficiency. In view of the importance of the main sulphur users in Canada's free economy, development necessarily takes account of their specific sulphur needs, their location in relation to sulphur sources and the technical aspects of sulphur use - in brief - the economics of sulphur supply.

At one end of the scale is imported American brimstone which, to Canada's largest sulphur user, the pulp and paper industry, is and, for nearly three decades, has been the cheapest and most convenient form of sulphur. The acid industry as a whole does not show this marked preference supported by decisive economic considerations although, for some individual acid plants, this is the case. At the other end of the scale is the utilisation of smelter gases. This

* All details of quantity are shown in short tons of 2,000 lbs. Additional statistics are shown in the Appendix.

indirect source of sulphur provides most of the sulphuric acid for the fertiliser industry and, by a recent development, supplies about 15% of the sulphur dioxide used by the pulp industry in direct and economic substitution of imported brimstone.

Between these extremes lie the two major potential sources of sulphur, namely pyrites and sulphur recovered from sour natural gas. The outstanding factor which prevents these two sources assuming the decisive role in the Canadian sulphur scene that they are intended to play is transport costs. In the case of by-product pyrites, this factor limits their wider use both in the home and export markets, although the latter offers increasingly wider scope. Technically, flash and fluo solid roasters provide suitable means of economically utilising pyrites and especially by-product flotation pyrites. Both incorporate many aspects designed to meet the technical requirements of the pulp and paper industry, thus making pyrites a more acceptable raw material.

The adverse location of many mills in relation to pyrites mines, however, prevents large-scale substitution for economic reasons, particularly if the larger capital costs of pyrites-burning plant is taken into account. To overcome this, a closer integration within the industry is taking place - new pyrites developments have only been effected in conjunction with a corresponding project of a sulphur user and it is probable that most of the future production schemes will similarly be planned to serve a specific user. In this connection, wider use of the Noranda Flash smelting process may prove economically advantageous. Even so, only by-product pyrites at very low ex-mine cost are competitive and production of pyrites, per se, is not likely for the time being.

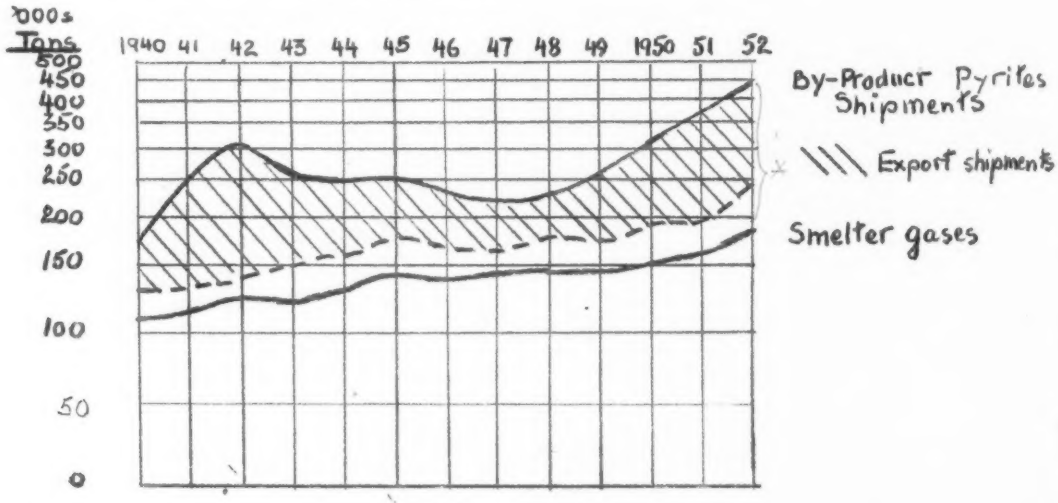
Recovered sulphur production which, with the inevitable expansion of natural gas exports from Alberta, could reach 150,000 tons per annum by 1955 and go on expanding, is even more handicapped by transport costs. Essentially needed by plants in British Columbia, Ontario and Eastern Canada, it would be subject to a rail haul of 800 up to 2,000 miles respectively and, at current freight rates, it can only be competitive in marginal areas or serve to attract new industries to Alberta.

From this outline and the subsequent details, it will be seen that, in the immediate future, only limited substitution of American brimstone appears possible. Development plans

provide for a reduction of about 25% in brimstone consumption which, by 1955, is expected to stand at about 300,000 t.p.a. Failing the production of large quantities of elemental sulphur within economic transport range, Canada can balance her sulphur budget only by exporting sulphur-bearing raw materials unsuitable for domestic requirements.* Since an increasing number of United States acid producers rely on cheap Canadian sulphur contained in pyrites, an equitable balance appears to be possible, even though self-sufficiency will have to await the interplay of more favourable economic factors.

PRODUCTION

The growth of Canadian sulphur output in its various forms is shown in the graph below:-



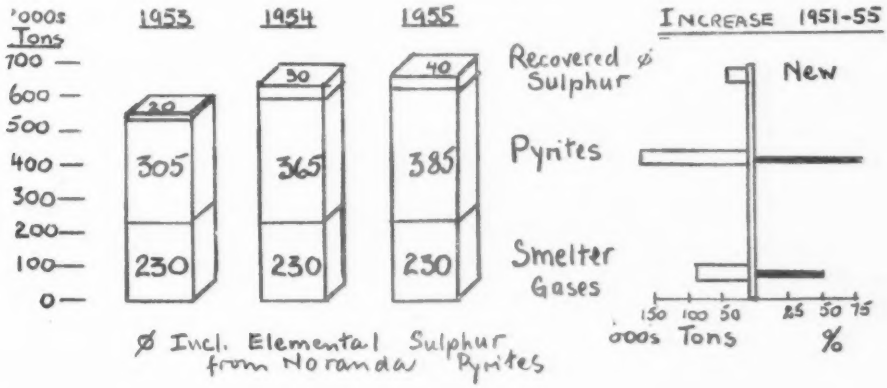
- Table I -

* Although not included in official Canadian statistics, large tonnages of sulphur are exported in the form of zinc blende, e.g. in 1952, the equivalent of about 80,000-90,000 tons of sulphur. Sulphur in home-consumed blende which is recovered from smelter gases is, of course, included.

The heavy fluctuation of sulphur production in the form of pyrites is largely attributable to the changes in the size of export markets of which the United States is the most important. In the five-year period up to 1952, total sulphur output has nearly doubled (92% increase) and the annual increase was remarkably steady at about 18%. In addition to officially reported production data for 1952, of sulphur in pyrites (254,599 tons) and in smelter gases (186,672 tons) totalling 441,271 tons, a small tonnage of sulphur (estimated at about 9,000 tons) was recovered from natural sour gas.

Based on details of the new production capacities under development, the pattern of production up to 1955 is expected to be as follows:-

-Table II-



It might be added that the tonnage for sulphur in pyrites is based on exports of 200,000 t.p.a., although this figure may well be an underestimate.

RECOVERED SULPHUR

The Shell Oil Company of Canada at Jumping Pound and the /Oil Royalite/Company at Turner Valley are at present the only producers. Hydrogen sulphide is extracted from natural sour gas and, from this, each Company processes pure (99.5% plus) sulphur at the rate of about 10,000 tons per annum. The Girbotol (Amine) and Claus processes respectively, both now generally adapted for this type of operation, are being used.

In view of the increasing importance of natural gas in the industrial life of the whole of Canada, substantially greater tonnages of sulphur could be recovered in the future, provided that the markets justified the installation of plant to recover sulphur from hydrogen sulphide which will, of course, accrue in proportion to the commercial gas output. Already gas pipelines to British Columbia and Ontario are virtually completed and the passing by the Provincial Legislature of the bill authorising the export of gas from Alberta is anticipated in the near future. It is probable that the negotiations between Alberta and the States of Washington and Oregon will result in further quantities of gas being piped to these destinations under a long-term agreement. At present, Pincher Creek Gasfield, which it is estimated could alone yield over 100,000 t.p.a. sulphur is capped but, as natural gas requirements increase, so this source may well be tapped. It might be added that the hydrogen sulphide content of gases at Pincher Creek is 8-9%, compared with 4% at Jumping Pound and 2-2.5% at Turner Valley. Canadian Gulf Oil Co. is reported to have completed plans for the utilisation of this important sulphur source.

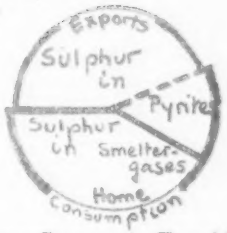
Summarising the above, the current output is 20,000 t.p.a. sulphur which is almost entirely consumed by the pulp and paper industry in British Columbia. The output at Jumping Pound is in fact integrated with the requirements of the pulp mills of the Powell River Co., British Columbia.

Another source connected with oil which, at present, remains dormant is the sulphur contained in the Athabasca Tar Sands at an estimated rate of 1½ million tons of sulphur per square mile. So far, the oil industry has given this matter only cursory attention and the main effort of examining the deposit and conducting experiments with a view to ultimate utilisation have been carried out by the Alberta Government. It is doubtful whether present availabilities of crude oil obtained by orthodox methods will warrant the very considerable expenditure required to make use of the enormous tar sands deposit and, without the utilisation of oil products, this sulphur can only remain as a dormant potential.

Metal Sulphides

The biggest potential source of sulphur under active development is that contained in pyrite, pyrrhotite and other metal sulphides and, with the exception of the Prairie Provinces, these minerals occur in abundance throughout Canada.

Although quantitatively production of sulphur in pyrites at present accounts for nearly 60% of Canada's total sulphur output, the sulphur contained in smelter gases is of greater importance, seeing that it accounts for over 75% of Canadian consumption of indigenous sulphur.



Smelter Gases

The Consolidated Smelting and Refining Co. at Trail, British Columbia, has been utilising the sulphur dioxide gases resulting from the base metal smelting and refining operations since the first World War. With the exception of a period from 1936 to 1943, when elemental sulphur was produced by the application of a modified Guggenheim process, the sulphur dioxide present in the stack gases in concentrations up to 7% is used directly or, if necessary, is concentrated to produce sulphuric acid by the contact process. Sulphur output is determined by the roasting capacity of lead and zinc concentrates and currently the potential is 165,000 tons of sulphur per annum.

The roasting of copper and nickel ores by the International Nickel Corporation at Sudbury, Ontario, similarly yields stack gases containing appreciable quantities of sulphur dioxide. These are utilised at the adjoining works of Canadian Industries Ltd. at Copper Cliff where, until recently, this Company produced only 35,000-45,000 t.p.a. of sulphuric acid (100%). Recent expansion of this plant has raised acid making capacity to 60,000-75,000 t.p.a. (equivalent to 20,000-25,000 tons of sulphur). Concurrently, the successful installation by International Nickel Corporation of a flash smelting process for copper concentrates in which the use of oxygen instead of air results in gases containing up to 75% sulphur dioxide enabled Canadian Industries Ltd. to start liquid sulphur dioxide production in November, 1952. At full capacity, this plant will produce 90,000 tons per annum, equivalent to 45,000 tons of sulphur which makes it the largest in the world. Needless to say, this material is being supplied to pulp and paper mills where it is directly substituting imported brimstone. At the same time, it is showing substantial operating economies.

An integrated project operating successfully since mid-1952 is that of Barvue Mines Ltd. and Aluminium Co. of Canada at Arvida, Quebec. Barvue Mines Ltd.'s output of zinc concentrates is roasted and the gases are used by Aluminium Co.

to make acid for their production of aluminium-sulphate, aluminium-chloride and other products used by the paper industry and in municipal water purification. This project has additional interest in that the calcined ore is being shipped to the American Zinc Lead and Smelting Co. of Illinois, who are expected to require up to 170,000 tons per annum, either in the form of calcines or as crude blende. The current output of sulphuric acid from this source is 35,000 t.p.a. (equivalent to about 12,000 tons of sulphur). It is probable that additional roasting facilities will be provided resulting in increased acid output and arisings of calcines.

Summarising the above, the total capacity of sulphur output in the form of smelter gases has reached 245,000 t.p.a. As shown in Table II actual output during the coming years is expected to be about 230,000 t.p.a.

Pyrites

Pyrites production in Canada is at present wholly in the form of by-product, obtained in the course of flotation of non-ferrous ores. The established producers are East Sullivan, Noranda, Waite Amulet and Quemont in Quebec and Britannia Mining and Smelting Co. in British Columbia. Increasing use of Canada's pyrites wealth is indicated by the following new projects which, incidentally, are the first examples of integration between pyrites producers and end users of sulphur products.

Consolidated Mining & Smelting and Refining Co. Pyrrhotite tailings accruing at the Company's ore concentrator at Kimberley are being consumed at the rate of 110,000 tons per annum at the sulphuric acid installation of the Company's new fertiliser plant which is standing in the vicinity of the concentrator. Hitherto, these tailings were burned occasionally at the Company's plant at Trail to augment normal acid output from smelter gases, whereas the new integrated project will dispose of a large proportion of the total arisings. The resulting iron oxide sinter is to be stockpiled pending its future use for possible pig-iron manufacture.

Britannia Mining and Smelting Co. In the course of the Company's copper operations, a stockpile of over 200,000 tons flotation pyrites concentrates have been accumulated and currently 200 tons per day are being added. By agreement with the Columbia Cellulose Co. - a subsidiary of Cellanese Corporation of America - these pyrites are now being roasted

in a Dorr type Fluo Solid plant and the sulphur dioxide is used in the Cellulose Company's new dissolving pulp mill at Prince Rupert, British Columbia.

Noranda Mines Ltd. In 1954, production will start at Noranda's new flash smelter at Welland, Ontario, adjacent to the plant of North American Cyanamid Ltd., who will use the annual output of 36,000 tons of sulphur in the form of sulphur dioxide for acid-making for their own consumption. The 18,000 tons of elemental sulphur, arising simultaneously, are likely to be disposed of to nearby pulp mills and brimstone acid plants.

There is a large number of new pyrites developments which were started during the last two years, but have been abandoned owing to lack of ready markets. Notable amongst these are the Normetal Mining Corporation Ltd. who abandoned by-product pyrites recovery from the treatment of copper-zinc ores at their 1,000 ton per day mine at Desmeloizes, W. Quebec, after six months' operation in 1952. Similarly, Weedon Pyrites and Copper Co., after shipping some small tonnages abroad in 1952, is now keeping its mill, near Sherbrooke, Quebec, (built for copper and pyrite concentrates production) on a care and maintenance basis, in the same way as the adjoining copper zinc properties of Ascot Metals Corporation and Sheffield Metals Corporation.

Major pyrites potentials awaiting exploitation, but already at an advanced stage of development, are Noranda's Horne Mine, the property at Dufresnay, formerly leased to Noranda, but now owned by the Company formed in 1952 by Noranda and McDonald Mines Ltd., the vast pyrites deposit on the Gaspé Peninsula of Noranda's subsidiary, Gaspé Copper Mines Ltd., the pyrites ore deposit of Barvue Mines Ltd. at Barvue, Quebec, the pyrites outfall at Buchans Mine, Newfoundland and the pyrite-copper-zinc sulphide deposit on the Ecstall River, in British Columbia. The combined potentials of these deposits are estimated at about 200 million tons of sulphur in pyrites.

Summarising briefly, it is anticipated that by-product pyrites shipments from mines, at present about ¼ million t.p.a. will increase at least 50% by 1955. This expansion is expected to take place as the result of integration with consumers' developments. The expansion of exports is very probable, but no allowance has been made for this in the above estimate.

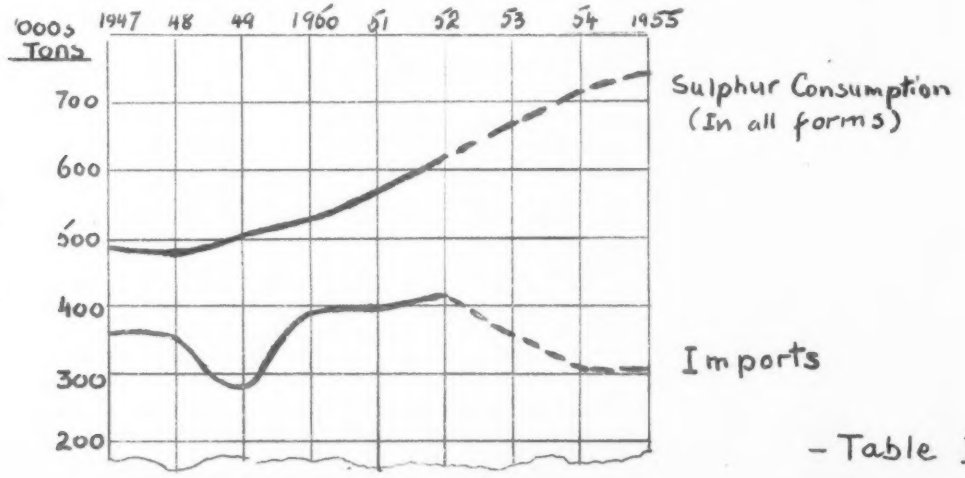
CONSUMPTION

It is estimated that, in 1952, a total of 620,000 tons of sulphur was consumed by Canadian industry, as against 561,000 tons in 1951. A brief comparison of the salient features of the consumption pattern of the U.S.A., U.K. and Canada

	U.S.A.	U.K.	Canada
Pulp and Paper	7%	1%	53%
Fertilisers	34%	34%	30%
Chemicals & Explosives	13%	16%	47%
Others	46%	49%	10%

reveals the dominating position of the paper and pulp industry and explains the importance of brimstone to the industry as a whole. The increased use of pyrites and smelter gases, however, has reduced the ratio of brimstone to other materials from about 2:1 in 1951 to 8:5. Of the current brimstone consumption, 78% is absorbed by the pulp and paper industry, 19% is turned into sulphuric acid and the balance used for "regular" purposes.

Sulphur consumption and imports during the past years are shown below, together with anticipated developments:-



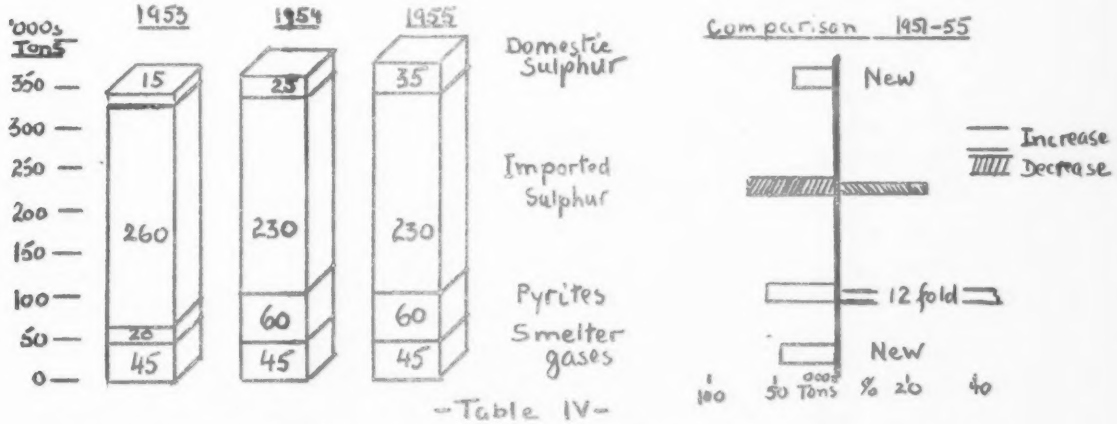
- Table III -

Total consumption in 1955 is expected to reach 740,000 to 750,000 tons, an increase of about 30% over 1951. An estimate of the various forms of sulphur consumption is as follows:-

	1953	1954	1955
	(Thousands Tons)		
Brimstone - Domestic	20	30	40
Imported	350	300	300
Total	370	330	340
Sulphur in Pyrites	80	160	180
Sulphur in Smelter Gases	220	230	230
	670	720	750

Pulp and Paper

In the five-year period 1947-1951, consumption increased 21% to 306,000 tons. By 1955, another five-year period, a similar expansion is anticipated which will bring consumption of sulphur in all forms to nearly 375,000 tons per annum. Use of the various raw materials is expected to be as follows:-



-Table IV-

Until Columbia Cellulose Co. at Prince Rupert, British Columbia, started using Britannia Beach pyrites last year, the St. Lawrence Paper Mills Ltd. of Three Rivers, Quebec, was the only pulp and paper mill obtaining its sulphur requirements exclusively in the form of pyrites. Seven other mills, including the Consolidated Paper Corporation at Grandmere, Quebec,

Bowater's Newfoundland Pulp and Paper Co., Abitibi Paper Co. are reported to be using or planning the use of pyrites in conjunction with Dorr-fluo solid roasters with a view to obtaining some, if not all, their sulphur dioxide requirements by this means. The Abitibi Paper Co. who, it will be recalled, assisted Canadian Industries Ltd. in proving the suitability of their new liquid sulphur dioxide production, may also cover some of their requirements from this source.

The need for suitable location in relation to its forest raw materials and water facilities prevents the pulp and paper industry from paying sufficient attention to accessible cheap sources of indigenous sulphur. Furthermore, the advantages of sulphur-burning units, such as lower capital and operating costs, the need for high sulphur dioxide concentrations, the absence of residues, etc. predispose this user to favour sulphur against pyrites.

It will be seen from the above data that elemental sulphur is expected to maintain its dominant position and it is thought that only a combination of very favourable circumstances could ever give pyrites a telling economic advantage. The converse is, of course, the case with liquid sulphur dioxide obtained from smelter gases.

Sulphuric Acid

Production during the five-year period 1947-1951 increased by 21% to 813,000 tons. It is expected that, during the period 1951-1955, acid production will increase by about 25% and Canada will thus dispose of over one million tons of acid annually by 1955. In 1952, exports of acid to the United States amounted to 33,000 tons, a reduction of 40% compared with 1951. It is expected that, during the coming years, between 50,000 and 80,000 tons per annum will be exported. Prior to the recent expansion of the industry, there were nine acid plants, as follows:-

Name of Company	Plant Location	Source of Material
Aluminium Co. of Canada Ltd.*	Arvida P.Q.	Brimstone
Canadian Industries Ltd.	Copper Cliff, Ont.	Smelter gas
Canadian Industries Ltd.	Hamilton, Ont.	Brimstone
The Consolidated Mining & Smelting Co. of Canada Ltd.*	Trail, B.C.	Smelter gas
Dominion Steel & Coal Corp. Ltd.*	Sydney, N.S.	Brimstone

Name of Company	Plant Location	Source of Material
Nichols Chemical Co. Ltd.	Valleyfield, P.Q.	Pyrite
Nichols Chemical Co. Ltd.	Sulphide, Ont.	Pyrite
Nichols Chemical Co. Ltd.	Barnet, B.C.	Pyrite
North American Cyanamid Ltd.*	Welland, Ont.	Brimstone

* Manufacture sulphuric acid wholly for their own use.

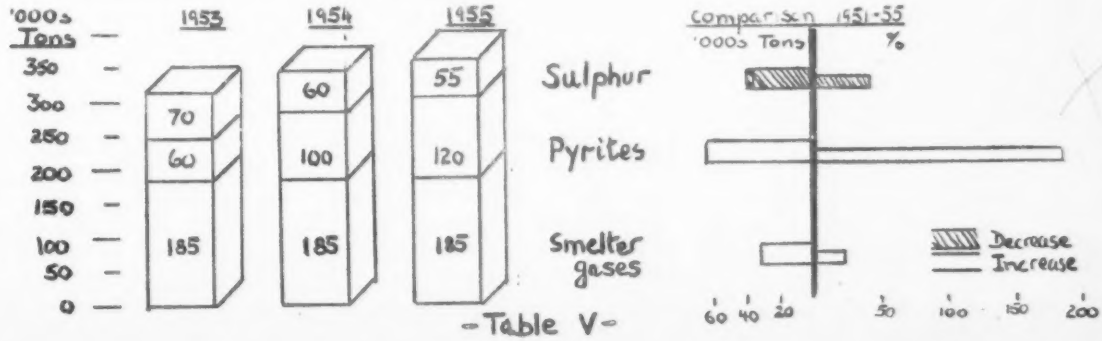
The new acid plants are:-

Name of Company	Plant Location	Source of Material
The Consolidated Mining & Smelting Co.of Canada Ltd.**	Kimberley, B.C.	Pyrrhotite
Aluminium Co.of Canada Ltd.**	Arvida, P.Q.	Smelter gas
North American Cyanamid Ltd.*	Welland, Ont.	Pyrite

The established plants which expanded under recent development schemes are:-

Name of Company	Plant Location	Source of Material
Canadian Industries Ltd.	Copper Cliff, Ont.	Smelter gas
Nichols Chemical Co. Ltd.	Valleyfield, P.Q.	Pyrite

Output capacities of these plants were expanded by 50% and 100% respectively. The use of the various raw materials by the industry is shown below:-



-Table V-

Apparent acid consumption in 1952 was 770,000 tons, the highest on record. The distribution of acid consumption conforms approximately to the following pattern:-

Fertilisers	510,000	Iron & Steel	31,000
Heavy Chemicals	85,000	Textiles	24,000
Explosives	32,000	Petroleum Refining	13,000
Coke & Gas	32,000	Miscellaneous	43,000

The increased acid output will be absorbed primarily by the fertiliser industry which, by 1955, is expected to consume about 620,000 tons, or about 20% more than in 1951. The biggest proportionate increases are anticipated in the textile and metallurgical industries which are expected to consume about 35,000 tons and 65,000 tons respectively, half as much again as in 1951.

Prices and Values

Imported American brimstone costs between £32 and £43 per ton at users' works according to location. Sulphur in smelter gases is valued at £10 per ton. Ex-mines prices of by-product pyrites range from £2.50 to £3.50 per ton, although, for special parcels, up to £7 is known to be realised. The average sulphur content of the pyrites from Quebec is 47-48% and 45-46% from British Columbia. In view of these low prices which are only about 1/5th of the value of comparable European pyrites, only by-product material can be marketed and pyrites mines as such appear, at present, to be unexploitable. Sulphur recovered from sour gases is reported to be valued at £18.50 per ton at recovery plant. Actual production costs have variously been estimated at £2 to £6, excluding plant amortisation, and the latter subject to plant size, up to £10 per ton. At present, pyrites incur a rail freight of about £2.50 per ton per hundred miles and the charges for sulphur are believed to be similar.

Conclusion

Developments in Canada are of particular interest to the United Kingdom since, at present, Canada is the only large source of sulphur in the Commonwealth. So far, comparatively small tonnages of pyrites have found their way from British Columbia, Quebec and, in the past, also from Newfoundland to acid makers in this country.

The possibility of obtaining cheap Canadian sulphur is an attractive prospect, particularly to British industry but, under

present conditions, it has no economic justification. The development of a new and economic technique in extracting sulphur from pyrites at the mine may go some way towards solving the problem of transport costs but this, by itself, is patently insufficient as is proved in the case of sulphur obtained from sour gas.

In view of the economic importance of these sulphur potentials, especially of recovered sulphur, it should be borne in mind that the apparent difficulties would largely be overcome by the application of special rail tariffs which, with specific destinations in home or export markets in view, could be justified. Looking to the future, the work on the St. Lawrence seaway, which will bring ocean-going vessels into the heart of Canada, may well revolutionise the transport situation to an extent that sources which today cannot conceivably be of interest even to Canadian industry may then compete favourably in the United Kingdom or other markets outside North America.

M E X I C O

About two years ago, a series of news items promising rich supplies from sulphur domes focused the attention of a sulphur-hungry world on a country which had, hitherto, produced only negligible quantities of rock sulphur. Yet the existence of sulphur domes in Mexico has been known for many years and, whereas there is no specific reason for the absence of earlier commercial exploitation, the stringent mining and tax legislation in Mexico, the nationalisation of the oil industry and plentiful sulphur supplies from the American side of the Gulf are but a few factors that may have been contributory. While the limelight of public interests was on sulphur domes, a modern sulphur recovery plant came into operation in April, 1951 and it is primarily this source that provides Mexico's sulphur requirements. The dome developments are none the less real and appear to be based on soberly judged economic and technical aspects and this applies also to the expansion plans in connection with rock sulphur deposits.

Salt Dome Production

The occurrence of salt domes extends across the Isthmus of Tehuantepec but, up to now, only a small number has satisfied the exacting geological, structural and physical requirements that are prerequisites to the successful employment of the Frasch process. Of the three most advanced projects which have, at the same time, shown the greatest potentialities, two are operated by Companies which are controlled by three brothers of American origin, named Brady. The Mexican Gulf Sulphur Co. S.A. have constructed a Frasch process plant at San Cristobal, Vera Cruz, twelve miles by water from Minatitlan. Delays in the production schedule have advanced the steaming date to October, 1953, and it is now expected that, given fulfilment of the expected dome formation and steaming results, sulphur will start flowing early in 1954. Preliminary data indicate that, in 1954, the plant is to operate at a rate of about 100,000 tons of sulphur per year which, in 1955, is to be raised to about 200,000 tons per year. Of a total estimated cost of five million dollars, the Export-Import Bank is reported to have contributed, by loan, $1,875,000.*

The other Brady Company is the Gulf Sulphur Company of Delaware, with its operating subsidiary, the Compania Azufre de Vera Cruz, S.A. This company is in the initial stages of erecting a 250,000 t.p.a. Frasch plant on the Chapas River at La Salinas, twelve miles by river from Minatitlan. This project is believed to be completely financed by private American capital, as no credits from Export-Import Bank have been reported. No anticipated completion date is reported, but it is unlikely to be earlier than 1956.

What appears to be the most important project has been initiated by the Pan-American Sulphur Company. Its operating subsidiary, the Gulf Sulphur de Mexico S.A., is erecting a similar Frasch plant at Jaltipan, eighteen miles by rail from Minatitlan. It is to have a capacity of 300,000 tons of sulphur per year and, although scheduled for completion in the summer of 1954, reliable reports indicate that, at the present rate of progress, it is not likely to come on flow until 1955. Construction of this plant is financed to the extent of 3.6 million dollars by the American Export-Import Bank. Conflicting reports have attributed this project to the ownership of the Brady Brothers, but this has now been reliably discounted.

* other sources report a total loan of $3.5 million.

Apart from an agreement between Jefferson Lake Sulphur Co. and Mexican Gulf Sulphur Co. in 1948, whereby the former Company was giving technical assistance in examining drilling results from San Cristobal dome, the above companies appear to be independent from the American sulphur producers. Of these, only Texas Gulf Sulphur Co. appears to be taking active steps in Mexico. They have a concession on the Isthmus of Tehuantepec, where they are exploring, through their subsidiary, Cia. Exploradora del Istmo, S.A. By all accounts, the domes discoveries by this Company have, to date, not shown the same promise as the above-mentioned projects, inasmuch as the dome structure was not deemed sufficiently robust to withstand the considerable pressure inherent in the Frasch process. The Texas Gulf concession area is, however, very extensive and the discovery of a suitable dome is thought to be only a matter of time. The Freeport Sulphur Co. is reported to have carried out a detailed reconnaissance of unconcessioned territories but, so far, without apparent results.

Sulphur Recovery

In Spring 1951, the sulphur recovery plant operated by Petroleos Mexicanos, in the gas field of Poza Rica, was brought on stream. Built by American engineers to designs by Allied and Chemical Dye Corporation and S. Schwartz of New York, the plant is second only in size to Texas Gulf Sulphur Co.'s plant at Worland, Wyoming, with an approximate capacity of 120 tons of pure sulphur per day.

Hydrogen sulphide is extracted from sour gas, which is brought in from the field through a series of compressors, in two Amine-type purification plants, each rated at 60 million cubic feet of gas per day. Sulphur recovery is effected by the Claus process, comprising the usual furnace, waste heat boiler, catalytic converters and condensers. The plant incorporates several special features to meet specific local requirements, but the method of sulphur solidification is of particular interest. By feeding the molten sulphur to a continuous water-bed supported steel belt (30" wide) a continuous ribbon of sulphur, about 5/16th" thick, results. On discharge, this breaks up into chips a few inches long, thus obviating blasting, chipping or other mechanical means necessary to shift sulphur solidified in vats. The sulphur is reported to be 99.9% pure and commercially free from deleterious elements. The hydrogen sulphide concentration of the gas feed is only 16.3%, which is

less than one third of that obtaining at Worland, but more than double, if not three times, the concentration obtaining in the Alberta Gas Fields. Girdler units apart, the plant capacity can be raised by up to 50%, with minor changes of existing equipment but, so far, its output has been below its rated capacity.

Rock Sulphur Deposits

Exploitation of this conventional form of sulphur has been effected since the early 'thirties by organised mining undertakings, but intermittent production is believed to have taken place before then.

Production rarely exceeded 10,000 tons a year, but more usually amounted to 2,000-3,000 tons. The deposits have a sulphur content of 25-70% and extraction and refining are carried out by autoclave or by a more primitive process, similar to the calcarone method practised in Sicily. The principal areas of exploitation are the volcanic regions in the neighbourhood of San Luis Potosi and in Lower California. In the former, Negociacion Minera de Azufre S.A., the most important rock sulphur producer, is operating at an annual output of about 10,000 tons. This Company is modernising its installation with a view to increasing its output. Conflicting reports forecast annual production of 20,000 and 35,000 tons respectively, but it is thought that the ultimate figure will depend on marketing facilities.

A new development that may reach substantial proportions is the project of the American Sulphur Refining Company near San Felipe on the Gulf of Lower California. The affiliated Mexican Company, Azufre Refinados de Mexico, S.A., was planning to start this year on preparatory work for open-cast operations, but it is now reported that exploitation is postponed owing to excessive production costs in relation to world prices. The sulphur-impregnated limestone is found below an overburden which, in places, is less than 10 ft. thick, but does not exceed 100 ft. over the entire deposit. The two existing concessions exploit pockets with a sulphur content of 99% and more. The average content of the deposit, running into many million tons of sulphur rock, is estimated at over 50%.

Another important development may take place on Socorro Island, where the Mexican Government has recently granted a sulphur concession. According to unconfirmed reports, the deposit is alleged to contain three-quarters to one million

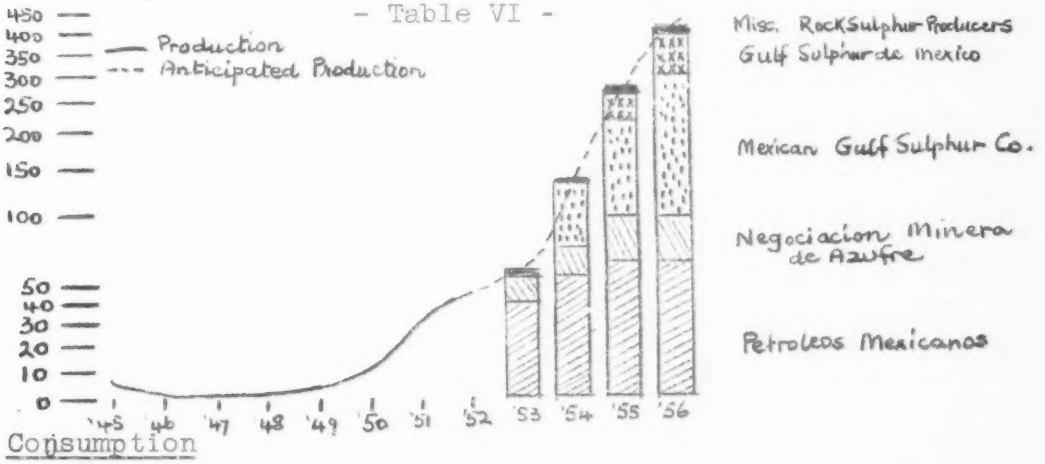
tons of rock containing up to 95% sulphur. The concession holders plan to produce annually 60,000-70,000 tons of sulphur and commence production early in 1955.

Other Sources

Mention should also be made of sulphur production in the form of sulphuric acid from smelter gases at the copper and lead refinery of American Smelting and Refining Co. at San Luis Potosi. Hitherto, these operations were designed to meet the Company's own requirements, but plant extensions are in progress, which will result in the production of acid equivalent to about 3,000 tons of sulphur per annum.

The following graph represents the activities of the various producers:-

- Table VI -



Consumption

When, in 1951, Mexico turned from a net consumer to a net producer of sulphur and was included by I.M.C. in the quota scheme, its own sulphur-consuming industries expanded at the same time, perhaps largely on account of being assured of future raw material supplies. Subject to minor fluctuations, the pattern of consumption, up to 1950, was made up as follows:-

6,000-7,000 tons sulphur for sulphuric acid production
1,000-2,000 tons sulphur for agricultural uses
2,000-4,000 tons sulphur for various other uses, including chemicals, pharmaceutics, etc.

With the additional supplies of recovered sulphur, the Mexican fertiliser industry was the first to expand and three new plants are reported to have come into operation during the last two years, notable amongst these the Government plant Guanos y Fertilizantes at Mexico City. Currently output of superphosphate, sulphate of ammonia and organic fertilisers is reported to be approaching 50,000 t.p.a. Unconfirmed reports put consumption of sulphur in 1952 at 25,000 tons.

Trade

The traditional supplier of Mexican sulphur needs was, of course, the United States, but small tonnages of pyrites have, from time to time, been shipped from Britannia Beach in British Columbia. Since Mexico's sulphur surplus accrued, this has found an outlet primarily to the West Indian sugar refineries, notably to Cuba and a parcel of 2,000-3,000 tons was bartered for Canadian newsprint. At the same time, Mexican sulphur is finding its way into the United States. It is difficult to determine at present what pattern Mexican sulphur exports will follow once all the production projects listed above have been realised. The Mexican sulphur producers are fully aware that they have to compete with American sulphur at level price terms and it is understood that the dome sulphur plans, formulated when American sulphur was 20% cheaper than it is now, make due allowance for this. American sulphur producers who are conscious of the increasing domestic pressure for their production would like to see the promised Mexican output relieve them of some of their Central and South American commitments and, at the same time, provide them with a ready reserve should the American market "get out of hand". So far, Mexican Frasch sulphur producers have not made any definite approaches to customers in Europe or elsewhere outside the Western Hemisphere, but this is partly due to the fact that the dollar shortage still bedevils international trade relations and because producers wish to await actual results from their domes.

The internal price of sulphur is reported to be $50* per ton and this is believed to apply to the Government controlled recovered sulphur production. It appears that this is reserved to meet internal demand and to provide the Government with a useful bartering commodity.

Active producers of sulphur from surface deposits, as well as those still in the development stage, appear to be aware of

* a price of $80 has also been quoted.

the need to produce at costs which permit sales prices comparable with United States sulphur. Judging by export offers currently circulating, the Mexican surface sulphur producers should stand a fair chance to pave the way in the international field until the larger quantities of Frasch sulphur come into the market.

Future Outlook

Mexico's industrial development plans which have been drawn up since the accession to Presidency of Senor Cortinez early this year can be said to favour the sulphur industry. On the mining side, very considerable tax concessions have been made by the Minister of Economy, Senor Loyo, and small and medium sized producers are to receive tax reliefs and subsidies. From an export point of view, the possibility of the replacement of the 15% ad valorem export tax on mined products by a straight revenue tax would also be advantageous to sulphur producers, since this would take into account narrow margins necessary if Mexican sulphur is to compete in world markets. The expansion programme in the industrial field provides primarily for basic industries, such as the iron and steel, coal and oil industries. At the same time, Mexico's agricultural programme will demand substantial quantities of fertilisers, insecticides and, in general, an expansion of the chemical industry.

Some of these development schemes are, as yet, in the blue-print stage, but there is little doubt that the Government intends their success and speedy implementation.

Thus, all sulphur producers should be assured of a growing and stable internal market and without being penalised by restrictions in their export plans.

PRICES AND TRENDS

The world price structure has undergone hardly any change in the past three months. Following the establishment of the higher United States home and export prices on 1st June, 1953, no new developments have taken place in this quarter and none

are thought likely for six to twelve months at least. In Italy, prices have been reduced as from 1st August by L.700 per metric ton (sterling equivalent - 8/-) for all grades and they now range from £26.16.0d. to £28.7.6d. per ton f.o.b. Sicilian port according to quality.

The unconfirmed reports from Australia of last June on Japanese sulphur producers quoting competitively with American brimstone are now confirmed. Negotiations are reported to be taking place between the Japanese Companies and the Australian Government Purchasing Board in respect of 10,000 tons of sulphur at a landed cost of £16 per ton. On the basis of known Japanese production costs, this price would necessitate their selling at about 40% below cost.

The following table shows a comparison of prices of sulphur of different origin. F.o.b. prices and freights are based on recent quotations.

	f.o.b. Country of Origin	Freight to U.K.	c.i.f. U.K.
United States	$28-$30.90	46/6 to 49/6 $16.50*	£12⅜ & £17 Av. say £13½
Italy	$79.50	28/- to 30/-	£29¾
Mexico	$30-$33	55/-	£13½
Chile	$60	65/- to 67/6‖	£24¾
Ecuador	$40	67/6‖	£17¾
Japan	$38≠	85/- to 104/6	£17¾ - £18¾
Canada	$18.50	£20	£26½

* 50% of U.S. sulphur exports have to be moved in U.S. bottoms; whereas U.S. liner freights are at present equivalent to about 50/-, U.S. tramps usually command premium freights.

‖ tramp freights. Corresponding liner freights from Chile and Ecuador are 133/- and $17.50 respectively.

≠ calculated on the basis of their offer to Australia. The freight quotations shown are tramp charter and liner terms respectively.

The supply situation in terms of cheap American brimstone has worsened in the last three months. Increased home demand in the United States has brought about a tighter export position and thus induced a number of consumers, including Australia and the United Kingdom, to seek small supplementary sources of supply outside the United States. It is quite conclusive that consumers everywhere are disinclined to pay high premiums over the ruling American export price level. This trend has resulted in almost complete stagnation of business in high-cost producing countries, such as South America and Italy. In the latter, accumulation of stocks may soon reach a quarter of a million tons. The slight recession in the Scandinavian pulp and paper industry has relieved the pressure on sulphur supplies and, in consequence, some transactions of Swedish and Norwegian sulphur outside their existing markets have taken place at prices very slightly above American price equivalents.

The present trend is expected to continue unless a business recession in the United States should reduce the present pressure of home demand and should induce American producers to balance their programme by increased export shipments.

UNITED STATES SULPHUR

Native Sulphur

Production during the second quarter of 1953 amounted to 1,354,699 tons, fractionally (¼%) less than during the corresponding period of 1952 but, compared with the first quarter of 1953, about 6½% more. The total output for the period January to June, 1953, amounted to 2,626,414 tons, which is ¾% less than during the corresponding half-year period of 1952.

Apparent sales during the second quarter, amounting to 1,478,106 tons, were nearly 12½% higher than during the corresponding period of 1952 and nearly 14% higher than during the first quarter of 1953. It is estimated that export shipments too were higher by 50,000-60,000 tons than the first quarter's total of 241,852 tons. Compared with

the corresponding period in 1952, when 659,037 tons were exported, this year's tonnage is over 100,000 tons lower. The exceptionally high sales total for May (590,067 tons) is partly attributable to U.S. and foreign consumers taking advantage of the lower prices ruling up to 30th May and this is borne out by a correspondingly lower June total of deliveries.

Similarly the stock position improved by about 50,000 tons in June, with the result that the overall reduction in the second quarter was only 123,407 tons. Total stocks at the end of June, 1953, were 2,919,545 tons, compared with 2,902,335 tons in June, 1952.

Recovered Sulphur

Output in June reached 30,077 tons, which raised the previous production level by a further 2,000 tons per month. The total production in the second quarter was 86,715 tons, an increase of 55%, compared with the corresponding period in 1952 and 5% compared with the first quarter of 1953. As anticipated, apparent sales of recovered sulphur in June much exceeded output and the month's total of 46,020 tons is the highest on record. The sales figure for the second quarter of 85,801 tons was about 55% higher than during the same period of 1952 and about 70% higher than during the first quarter of 1953.

Stocks of recovered sulphur at the end of June, 1953, amounted to 127,930 tons, compared with 98,613 tons in June, 1952.

Examining the first six months' results, the following points are thought to be significant:-

(a) Production is only slightly higher (0.9%) than in 1952.

(b) In spite of lower exports, total apparent sales are 9% higher.

Although the impending price increase boosted April/May sales, it is reported that, in July and August, the high level of home demand has been maintained, with the result that export shipments had to be curtailed.

The view is widely held that, unless the present level of industrial activity recedes, the home consumption of sulphur in the United States will impose a strain on the production capacities, at all events until new production alters the present trend.

SULPHUR IN ITALY

Subject to official confirmation by Ente Zolfi Italiani, the production of raw sulphur in Italy during the first half of the year is reported at 105,882 metric tons. This represents an increase of 9% compared with the same period in 1952 and 15% compared with 1951. Whereas deliveries to the home market of 47,203 tons were only a little lower than during the equivalent period of 1952, exports of 3,462 tons were less than one tenth of the half-year tonnage in 1952 and only 7% of that in 1951.

The increase in production is wholly attributable to the Ente Zolfi Italiani payment system, based on average production costs, whereby producers are paid for all their deliveries to E.Z.I. warehouses, irrespective of E.Z.I.'s ability to dispose of the sulphur. The drop in exports is, of course, entirely attributable to the ruling high price levels. According to latest reports, stocks in August were about 200,000 tons.

According to official accounts, modernisation and mechanisation of sulphur mines is proceeding satisfactorily. Under the terms of the law which set aside L.9 billion* for this purpose, seventy-one producers have submitted requests for financing. The Inter-Ministerial Committee has accepted forty-seven out of the seventy-one applications which would, if approved, virtually exhaust the fund but, so far, only seven producers have provided the necessary guarantees. Loan contracts for 3.65 billion lire have been stipulated of which 1.2 billion lire have been distributed and, to date, about 0.9 billion lire have been spent mostly on new machinery in Italy, the United States and Germany. Requests for guarantees are under examination by banking institutions from twenty-two other mines, in respect of the 4.3 billion lire.

* Sterling Equivalent - £5.1 million

Of the major mines known to have installed modern plant, the following might be mentioned:-

The Societe Cozzo Disi (Countess Perrier) is reported to be putting into operation this month a Denver Flotation Plant. Since this plant is expected to yield a 95% sulphur concentrate, which it is hoped will be marketable as such to agricultural users, no further refining is envisaged.

The Societe Valsalso is expected to install shortly a flotation plant, which they ordered two years ago from the German firm of Humboldt. Following a recent re-examination of reserves, which gave disappointing results, the Company abandoned the intended purchase of a Languedocienne Refinery plant and decided to order the cheaper, though less efficient, Humboldt filter plant instead.

Bulk 120 tpd

The Montecatini concern is installing a "Masobello" plant at the Perticara mine in Northern Italy and Compania Generale Zolfi a similar plant in their Saponaro mine in Sicily.

There is considerable interest both in Italy and in consuming circles abroad as to what attitude E.Z.I. will adopt once these producers, who have modernised their plant, have brought down their costs to internationally competitive levels, while the rest of the industry is still struggling as at present. In the meantime, E.Z.I. with rising stocks and supplies purchased by them at double the ruling world prices may, before very long, in default of an increased world price, which is considered unlikely, have to sell at a considerable loss and to face the possibility of complete revision of the present policy.

O.E.E.C. CHEMICAL PRODUCTS COMMITTEE REPORT ON THE SULPHUROUS RAW MATERIAL POSITION IN 1952

The scope of this report is confined to events in O.E.E.C. countries with the exception of Turkey, which country failed to submit an account of their position. In the first part of the report, the changes during the year are surveyed and it is concluded that, in the second half of 1952, compared with the first half:-

(a) production of sulphurous materials increased slightly

(b) consumption of sulphurous materials decreased considerably

(c) production and consumption of sulphuric acid decreased although the decline in consumption for fertiliser use was less than the decline in consumption in its use for other purposes.

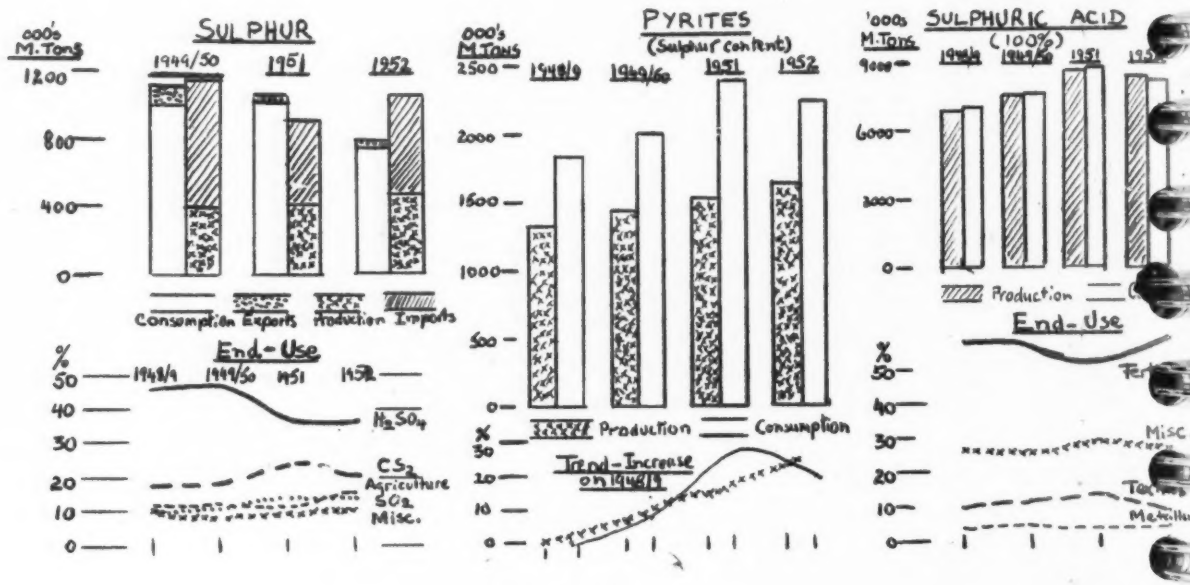
In the second part, a comparative survey is made of the position in 1952 and that in previous years and the report concludes as follows:-

(a) From 1951 to 1952, the situation regarding sulphurous raw materials changed from a deficit to a surplus of approximately the same size. For native and recovered sulphur, the surplus amounted to about 260,000 tons and for sulphur in pyrites 130,000 tons. For blendes and other sulphurous raw materials, consumption and exports slightly exceeded production and imports.

(b) Some of the improvement is attributable to the falling off of acid production (minus 5%) and consumption (minus 6%) and, should the demand rise again, a critical supply situation may result. Member countries are urged to pursue their efforts to increase production of sulphurous raw materials, economise in the use of sulphur and to substitute other raw materials wherever possible.

Following the examination of the statistical details contained in the report, it is thought that the above conclusions fail to convey the extent of the influence of the trade recession in bringing about the favourable overall position, not only from the point of view of lower consumption in all branches of industry in the United Kingdom and even more so on the continent, but also as shown by the 7% increase of American brimstone imports. Nor is any reference made to the fact that only a grave stringency of supplies is likely to cause high-priced Italian sulphur, which represents

the bulk of the resultant stock accumulation, to pass into consumption. The report does not allay any misgivings which were raised by the earlier O.E.E.C. Survey covering the outlook up to 1955.



- Table VII -

UNITED KINGDOM SULPHUR

During the second quarter of 1953, consumption of sulphur in all forms amounted to about 184,000 tons, compared with about 182,000 tons during the first quarter of the year. The rate of sulphur consumption during the quarter was 21% higher than that obtaining in 1952, but 12% higher than the 1951 rate.

It is estimated that, of the above total consumption, 32% was met from indigenous sources (spent oxide, anhydrite, sulphur from zinc smelter gases, sulphur recovered from oil refining), 24½% in the form of imported pyrites and 43½% in the form of imported brimstone.

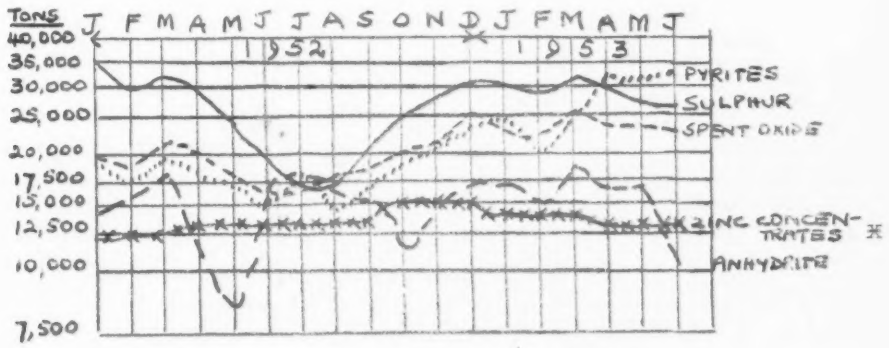
The following raw materials were consumed:-

	2nd Qtr. 1953	1st Qtr. 1953		2nd Qtr. 1952	
Sulphur					
(a) Acid	61,800	67,300	-8%	52,800	+17%
(b) Regular	21,700	23,100	-6%	19,300	+12½%
Total	83,500	90,400	-7½%	72,100	+15¾%
Pyrites	95,900	69,600	+38%	49,600	+93½%
Spent Oxide	68,700	71,900	-4½%	53,400	+28½%
Zinc concentrates	40,000	41,000	-2½%	40,500	- 1¼%
Anhydrite	45,700	50,000	-8½%	35,900	+27¼%

The percentage figures shown indicate the change between the earlier periods and the 2nd Quarter, 1953.

The monthly consumption figures of raw materials are depicted below:-

- Table VIII -



* Graph of sulphur consumption in zinc concentrates based on quarterly data.

The most significant change is the increase of pyrites consumption, due to a number of new roasting plants coming into operation. These plants are estimated to have a combined consumption capacity of about 85,000 tons pyrites per annum. Additional pyrites plants are expected to come into operation in the course of the coming months, although they are believed to be somewhat behind schedule.

Sulphuric Acid

Production during the second Quarter amounted to 459,800 tons, an increase of about 2% compared with the first Quarter and of about 33% compared with the second Quarter of 1952. The rate of acid production is the highest on record and it resulted from the use of sulphur-bearing raw materials in the following proportions:-

	2nd Qtr. 1953	1952
Sulphur	38½%	43%
Sulphur in Pyrites	27½%	20%
Sulphur in Spent Oxide	20½%	22%
Sulphur in Anhydrite	5½%	6%
Sulphur in Zinc Smelter Gases	8%	9%

During the 2nd Quarter, overall utilisation of capacity amounted to 81.3% compared with 84.1% in the first Quarter. The reduction is mainly attributable to a lower employment of chamber plant capacities. It is believed that, during the second Quarter, sulphur-burning acid plants were able to work at about 67% of capacity, which is still within their economic working range.

Stocks

A further decline of 20,000 tons in sulphur stocks resulted in end of June inventories being reduced to a total of 159,000 tons. Pyrites stocks at 501,000 tons showed a fractional decline (½%) on end of March inventories and spent oxide stocks declined to 195,500 tons, a change of about 4%.

The most significant features of sulphur developments during the second Quarter are:-

(a) The continued reduction of the use of sulphur in sulphuric acid manufacture and the simultaneous

coming on stream of new pyrites roasting acid plants.

(b) The running down of sulphur stocks which process is believed to have gained in momentum during the 3rd Quarter owing to a shortfall of American supplies below quota level.

C U R R E N T E V E N T S

Australia

It is anticipated that the Federal Government of Australia will give some financial assistance towards the installation of two new pyrites-burning plants. Between them, these plants should produce 150,000 tons of sulphuric acid per year. Established plants use imported brimstone at a cost of £20 per ton, whereas the pyrites from Nairne and Mt. Morgan cost considerably more.

New Zealand

The New Zealand Mines Department and the Department of Scientific and Industrial Research are investigating the existence of a deposit of pyrites which is reported to be a quarter of a mile wide and situated near Thames on the Coromandel Peninsula.

United States Sulphur Export Quota

The Office of International Trade established export quotas for crude and refined sulphur for the third Quarter at 250,000 tons and 15,000 tons respectively. These tonnages represent an increase of 17,500 in the crude quota and 2,500 tons in the refined sulphur quota. The crude sulphur quota for the United Kingdom was established at 46,000 tons. It will be seen from the account on Page 31 that the current consumption of sulphur in the United Kingdom is nearly double this figure.

Freeport Sulphur Company

The progress of the Company's development project and their likely impact on the world sulphur supply situation were recently discussed with two senior executives of the Freeport Sulphur Company and the undermentioned details supplement or correct those given in the June issue of the Bulletin.

Hoskins Mound is now expected to continue during 1953 producing at the rate of 200,000 to 250,000 tons per annum, although exhaustion is thought to be imminent.

Bay St. Elaine Dome only reached the estimated peak output of 100,000 tons per annum during the summer months, but is expected to maintain this from now on.

Nash Dome is expected to come into production as previously indicated, although the output in 1954 may not quite reach 70,000 tons.

Chacahoula Dome will probably come into production in 1955 and it is this Dome and not Bay St. Elaine which is intended to replace the moribund Hoskins Mound.

The Company's principal development, Garden Island Bay Dome, was not intended to come into production until early 1954, in which year it was gradually to have worked up to its peak rate of 500,000 tons per annum. It is now likely that the steaming date will be advanced to November, 1953, so that, before the end of the year, some production from this source is probable.

In view of the continued excellent performance of its chief producer, the Grand Ecaille Dome, the Company is now quite confident that it will attain an output of 2,000,000 tons per annum by 1955, if not earlier, and the Company's sales policy is being shaped with this target in view.

Texas Gulf Sulphur Company

It is reliably reported that Boling Dome is currently producing at just over 2,000,000 t.p.a. It is believed that the reduction of output from a level of nearly 3,000,000 t.p.a. in 1950 and 1951 is the outcome of the Company's deliberate policy of conservation and that the expansion of production at Moss Bluff is intended to be compensatory. It is estimated

that, in 1952, Moss Bluff produced about 370,000 tons and that, by now, production capacity has been increased by at least 200,000-300,000 t.p.a.

The difficulties at Spindletop Dome, occasioned by old oil-bores being encountered in the course of putting down further wells, are thought to have been overcome during the early summer months, since when a production rate of about 150,000 t.p.a. is believed to have been maintained. It is reported that the output continues to show a high bitumen content (0.6%-0.9%) and it is marketed as "black" sulphur at $1 discount.

France

The production of refined sulphur by the Societe Languedocienne de Recherches et d'Exploitation Minieres at their plant at Narbonne has been suspended since July. Because refined sulphur is produced from rock containing 8% sulphur, annual production costs were high, in fact, approximately on parity with imported Italian sulphur. When supplies of American sulphur at about half the cost of indigenous and Italian material were reaching France in sufficient quantities, the necessity to suspend operations became inevitable. During the first six months of the year, 11,000 tons of first-class material had been produced and the efficiency and suitability of the plant had thereby been amply illustrated.

East German Anhydrite Sulphuric Acid Plant

The East German official News Agency announced at the end of August that sulphuric acid production had started at the new anhydrite plant at Wolfen, near Bitterfeld, which is expected to be in full production some time next year.

It will be recalled that the giant plant erected there by I.G. Farben Industrie between 1936 and 1940 was dismantled by the Russian occupation forces after the war and removed to Russia. The new plant was planned as a replica of the old one, which consisted of four rotary kilns, 70 metres long and 3.2 metres in diameter, with a capacity of 400 tons acid per day. According to official accounts, the new plant is to treble Eastern Germany's acid output. If these two statements are to be reconciled, they imply that acid production during the past three years has declined appreciably.

East German acid supplies, which are obtained by the roasting of indigenous and imported pyrites, the latter mainly from Scandinavia, and by the utilisation of smelter gases at the Mansfeld copper smelter, are understood to be insufficient to meet requirements. This new acid production will thus be of great value to the East German economy and the anticipated new production of synthetic fibre, rayon and chemical products has already received much official comment.

Ecuador

The Ecuadorian Sulphur Corporation has decided to resume production with effect from 1st October, 1953. It will be recalled that, owing to labour difficulties and delays in the erection of their new refining plant, operations were suspended in April. By their original agreement with the Ecuadorian Government, a minimum royalty has to be paid by the Company, failing which the capital equipment would be forfeit. The decision to resume operations was undoubtedly influenced by these factors. It is reported that the difficulties encountered with the new plant should be resolved before long and the Company would then be in a position to abandon the use of autoclaves which are designed to produce 1,000 tons per month. The autoclave sulphur is being offered at about £40 per ton f.o.b. Guayaquil but, in view of comparatively high freight rates from this port, the material is unlikely to compete in world markets. With the new plant in operation, the Company hopes to produce 36,000 tons per annum at competitive prices.

Venezuela

According to unconfirmed reports, the Venezuelan Sulphur Corporation may switch its attention from the well-known deposit at El Pilar, near Carupano, to newly discovered deposits in the State of Anzoategui. It will be recalled that, in co-operation with French interests, the Venezuelan Sulphur Corporation had proposed to mine at El Pilar and produce refined sulphur at the rate of a quarter of a million tons per annum. The new deposit situated in the vicinity of Puerto Piritu is alleged by some sources to be a sulphur dome but, so far, no corroborating evidence has been forthcoming. The present concession holders are seeking foreign capital with a view to large-scale exploitation.

Chile - Aucanquilcha

It is reported that this major producer is supplementing part of its autoclave installations by an up-to-date flotation plant. Currently, Aucanquilcha are in a position to produce 6,000 tons per month, but it is believed that production has been severely curtailed since virtually no export tonnages are being moved, due to high prices.

Japan - New Production

An interesting development project has recently been initiated by important Japanese rayon pulp and metal interests. The Kokusaku Pulp, Mitsubishi Rayon, Teikoku Rayon, Ryoka Sangyo, Mitsubishi Metal Mining Co. and Nemura Kogyo Companies have jointly formed the Musa Mining Company with a capital of one hundred million yen to develop and exploit the vast sulphur deposit in the northern part of Nemuro, Hokkaido. The rock sulphur deposit, which is of volcanic origin, will be exploited by open cast mining and the sulphur rock will be refined by the well-known Masobello process, developed by the Italiana Gasogeni e Forni S.A. of Milan. The plant is rated at 18,000 tons per annum of refined sulphur and production costs, including depreciation, are expected to be about 10,000 yen per ton (about £10) i.e. about equal to the price of American sulphur. Road and rail transport facilities are being completed this year and, by mid-1954, the plant currently under construction in Italy is expected to be installed. The total cost of the venture is comparatively high, being about £500,000, but the resultant sulphur will be produced at about half the cost at present ruling in Japan.

Japan - Statistics

Production of crude sulphur in August, 1953, is reported to have amounted to about 14,000 tons, compared with an average of about 17,000 tons for the first half year. Domestic requirements are reported to average 13,000 tons per month. Owing to high production costs, Japanese sulphur had ceased to be marketable internationally earlier this year and stocks accumulated to the extent of 20,000 tons by the end of August. As reported on Page 24 by reducing their sale price below production costs, half of this tonnage is likely to be disposed of to Australia.

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STATISTICAL APPENDIX

CANADA

	Production (In Pyrites&Gases) (Thousands Short Tons Sulphur)	Imports* (Brimstone)	Exports (In Pyrites)	Apparent Consumption
Average 1940/46	246.4	245.4	96.5	395.3
1947	221.8	361.4	56.3	526.9
1948	229.5	354.6	50.3	533.8
1949	261.9	280.6	90.6	451.9
1950	302.3	390.3	111.6	580.0
1951	371.8	395.9	178.0	589.7
1952	441.3	415.2	197.9	658.6

* From U.S.A. except 2,756 tons in 1951 from Mexico.

Distribution of Consumption (Thousands Short Tons)
(As published by the Dominion Bureau of Statistics)

	1947	1948	1949	1950	1951
Pulp & Paper	253.4	260.9	255.4	282.6	306.0
Heavy Chemicals	228.7	205.2	244.9	230.7	245.4
Rubber	2.2	2.1	2.0	2.5	2.7
Insecticides	1.5	1.3	1.4	4.1	3.6
Explosives	1.5	1.8	1.7	1.9	2.1
Miscellaneous	0.9	1.1	1.2	1.2	1.3
	488.2	472.4	506.6	523.0	561.1

Distribution of Exports (Thousands Short tons Sulphur in Pyrites)

	1947	1948	1949	1950	1951	1952
U.S.A.	53.3	47.1	60.3	110.3	114.6	154.7
Mexico	3.0	3.2	1.9	1.3	1.8	1.4
Japan	-	-	28.4	-	30.4	7.8
U.K.	-	-	-	-	7.9	4.9
France	-	-	-	-	23.3	-
Netherlands	-	-	-	-	-	29.1
	56.3	50.3	90.6	111.6	178.0	197.9

Germany 0.1

Sulphuric Acid (Thousands Short Tons of 100% acid)

	Production*	Imports	Exports	Apparent Consumption
1947	668.8	0.1	29.9	639.0
1948	679.4	0.1	29.5	650.0
1949	707.7	-	17.3	690.4
1950	756.1	0.3	44.4	712.0
1951	813.2	1.2	57.0	757.4
1952	803.7	0.1	33.1	770.7

* About 65% captive

PRODUCTION 1952*

	Native & Recovered	In Pyrites	In other Forms	Total
Austria	-	2.0	4.6	6.6
Belgium	0.4	-	2.6	3.0
Denmark	-	-	1.6	1.6
Eire	-	-	0.6	0.6
France	15.5	124.4	45.9	185.8
W. Germany	52.0	192.0	80.5	324.5
Greece	-	92.4	9.0	101.4
Italy	236.4	514.0	85.6	836.0
Netherlands	3.9	-	4.9	8.8
Norway	104.7	170.0	3.5	278.2
Portugal	14.9	342.5	-	357.4
Sweden	17.8	197.5	21.3	236.6
Switzerland	-	-	0.8	0.8
U.K.	15.1	3.5	342.6‖	361.2
	460.7	1638.3	603.5	2702.5

CONSUMPTION 1952*

	Native & Recovered	In Pyrites	In other Forms	Total
Austria	17.1	27.7	3.0	47.8
Belgium	41.2	161.0	115.0	317.2
Denmark	0.9	57.6	0.2	58.7
Eire	0.2	26.0	0.6	26.8
France	93.6	340.5	74.6	508.7
W. Germany	62.1	575.0	136.8	773.9
Greece	12.7	20.6	6.6	39.9
Italy	79.3	417.0	73.7	570.0
Netherlands	3.0	164.9	21.6	189.5
Norway	26.0	44.5	9.2	79.7
Portugal	12.0	27.9	-	39.9
Sweden	56.9	225.5	-	282.4
Switzerland	23.0	37.5	0.1	60.6
U.K.	307.0	106.1	398.3‖	811.4
	735.0	2231.8	839.7	3806.5

‖ Including anhydrite used in direct ammonium sulphate manufacture

* Collated from O.E.E.C. Chemical Products Committee Report of 1952
All quantities shown in thousands metric tons.